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Renewable Energy
Development
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July 6, 2015

Ms. Michele Dermer
EPA Region 9, WTR-9
75 Hawthorne St.
San Francisco, CA 94105

Subject: External Mechanical Integrity Test
PG&E Test Injection/Withdrawal Well 1
Permit No. R9UIC-CA5-FY13-1
King Island, San Joaquin County, California

Dear Ms. Dermer:

Section D.2.a.iii of Permit No. R9UIC-CA5-FY13-1 (the Permit) requires that PG&E conduct an external Mechanical Integrity Test (MIT) on PG&E Test Injection/Withdrawal (I/W) Well 1 to demonstrate that there is no fluid movement between zones through the cemented annulus, and that there are no leaks in the tubing, casing, packer and casing shoe. Section D.2.a.iii of the Permit stated that the external MIT shall be scheduled to occur approximately 90 days after the start of injection. In their letter to EPA dated April 9, 2015, PG&E requested EPA's approval to schedule the MIT approximately 120 days after the start of injection, and in an email to PG&E dated April 10, 2015, the EPA approved PG&E's request. The external MIT was performed on June 18, 2015, which was 124 days after the start of injection.

The external MIT was performed in accordance with the External Mechanical Integrity Test Procedure, prepared by Irani Engineering and dated March 16, 2015. The PG&E cover letter dated March 18, 2015 submitted to EPA with the MIT procedure provided justification for changes to the logging techniques specified in Section D.2.a.iii of the Permit, which were a thermal decay log and a spinner log. PG&E proposed that a noise survey be substituted for a spinner log and that a temperature decay log also be run in accordance with the procedures in Appendix D of the Permit. In their comments submitted to PG&E on April 6, 2015, EPA accepted the program to run a noise log and temperature decay log, but asked that PG&E justify omission of the thermal decay log. PG&E's April 9, 2015 letter to EPA indicated that the reference to a thermal decay log in Attachment P of the UIC application that led to its inclusion in the Permit was an error, and that the log should have been called a temperature decay log. EPA accepted this clarification in their email to PG&E dated April 10, 2015.

The external MIT program for the I/W well was initiated at 7:00 am on June 18, 2015. The noise and temperature decay logging was performed by Cogco Wireline and supervised by Hamid Irani with Irani Engineering. Joel Coffman with the EPA witnessed the logging operations. At the time of MIT logging, the I/W well had been shut-in for 14 days (since June 4, 2015). In accordance with EPA temperature logging requirements (Appendix D of the Permit), the temperature and the noise logging tools were run with a casing collar locator (CCL) tool and a historic gamma ray curve was added in track 1 of the logs. The gamma ray curve was obtained from the radial cement bond log (CBL) run on October 24, 2014, which is the only cased-hole gamma ray curve available for the I/W well. The two temperature logs and the noise log were run from surface to the bottom of the well at 4813'.

The first temperature log was run at a speed of 36 to 47 feet per minute, which is within the allowable range of 20 to 50 feet per minute specified in Appendix D of the Permit. The second temperature log was run at a logging speed of 36 feet per minute. The EPA representative approved the different logging speeds for the two temperature logs. The second temperature log was run about 4-hours after the first run, in accordance with the 4-hour minimum period between runs specified in Appendix D of the Permit. The EPA representative approved the horizontal scale for the temperature logs, which was 74 – 144 °F full scale for absolute temperature and 1 °F per inch for differential temperature.

The first and second temperature logs were compared and no anomalies indicating a possible loss of well mechanical integrity were noted. However, there is a significant change in temperature gradient that starts at approximately 4695' and continues to the total logging depth of 4813'. An uncharacteristic temperature increase occurs in the Mokelumne River Formation (MRF; from 4710' to total depth) and is most pronounced in the MRF sand lobes, which due to their higher permeability compared to the shale breaks, is where the injected air entered during the compression test. This localized temperature increase in the I/W well is currently under investigation.

The noise log was run in the time period between the first and second temperature logs. Noise data was recorded at 4741' (25 feet below casing shoe), 4716' (casing shoe depth), 4691' (25 feet above casing shoe), 4,639' (25 feet below packer), 4614' (packer depth) and 4589' (25 feet above packer), 4400' and then every 200' to surface. No leaks or suspected leak intervals were detected.

Based on the results of the temperature and noise logging conducted on June 18, 2015, there is no indication of a loss of mechanical integrity of the I/W well.

The external MIT temperature and noise logs and field report for Test Injection/Withdrawal Well 1 are enclosed as one hard copy each and as PDFs in a data CD. The files have also been uploaded to PG&E's Dropbox account, which can be accessed at the following link:

<https://www.dropbox.com/sh/mf2qnl5v016e78f/AABIm-gfjIKWPpVCKe7hUgA6a?dl=0>

If you have any questions regarding this submittal or require additional information, please feel free to contact me at (415) 973-6270.

Sincerely,

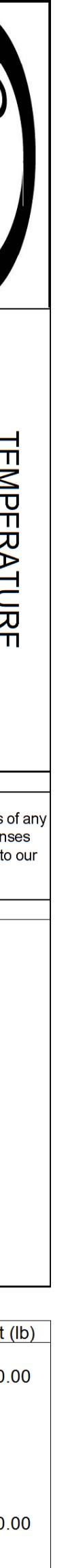


Mike Medeiros
Manager, Renewable Energy Development

Cc: Mr. James Walker, EPA Consultant
 Mr. Michael Woods, Division of Oil, Gas and Geothermal Resources
 Ms. Anne L. Olson, Central Valley Regional Water Quality Control Board

Enclosures: (1) Temperature Log Run 1
 (2) Temperature Log Run 2
 (3) Temperature Log Runs 1 and 2
 (4) Noise Log
 (5) External MIT Field Report

ENCLOSURE 1
Temperature Log Run 1



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TEMPERATURE SURVEY RUN ONE

Company	PG&E	Well	PG&E TEST INJECTION/WITHDRAWAL WELL 1		
Field	KING ISLAND GAS	County	SAN JOAQUIN	State	CALIFORNIA
Location:	NAD27: X:1734860.641 Y:577346.753 NAD83: LAT:38.081988814 LONG: -121.422161054			API #:	04-077-20739
Permanent Datum	SEC 27	TWP 3N	RGE 5E	Other Services	NOISE SURVEY
Log Measured From	G.L.	K.B.	Elevation	Elevation	
Drilling Measured From	K.B.	12'	-3.8'	K.B.	8.3'
Date	6-18-2015			D.F. -----	
Run Number	ONE			G.L.	-3.8'
Depth Driller	4813'				
Bottom Logger	4813'				
Top Log Interval	SURFACE				
Open Hole Size	N/A				
Type Fluid	N/A				
Density / Viscosity	N/A				
Max. Recorded Temp.	141.8 DEG.F.				
Estimated Cement Top	NA				
Time Well Ready	8:30AM/3:00PM				
Time Logger on Bottom	11AM/6:21PM				
Equipment Number	740/MAST				
Location	WOODLAND				
Recorded By	JAMES LEMS				
Witnessed By	MR. HAMID IRANI				
Borehole Record	EPA			JOEL COFFMAN	
Run Number	Bit	From	To	Tubing Record	
Surface String		13 5/8"	Vtg#J-55	Top	Bottom
Production String		5 1/2"	17#J-55	From	To
Liner		40# J-55&N-80	SURFACE		
		WIRE WRAP	4687'		

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All interpretations are opinions based on inferences from electrical or other measurements and we cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions set out in our current Price Schedule.

Comments

Historic Gamma Ray Log Taken From Halliburton CBL/NCL that was ran 24 Oct. 2014
EPA representative approved horizontal scale for temperature logs;
74 - 144 degrees F. full scale for absolute temperature
and 1 degree per inch for delta temperature.

WELL SHUT IN FROM JUNE 4, 2015

Sensor	Offset (ft)	Schematic	Description	Len (ft)	OD (in)	Wt (lb)
CCL	4.00		STNDRD Standard Cable Head	1.00	1.44	10.00
			169_5 1 11/16" Tungsten Bar	5.00	1.69	60.00
			169_5 1 11/16" Tungsten Bar	5.00	1.69	60.00
			169_5 1 11/16" Tungsten Bar	5.00	1.69	60.00
			CCL-AES (AES_12-45)	2.00	1.38	500.00
TEMP	0.35		TEMP-AES (ASE_16-34) AES 1 3/8" TEMP TOOL	3.00	1.38	10.00

Dataset: (6-18-2015) pge test iw well 1.db: field/well/run1/merge14
Total Length: 26.00 ft
Total Weight: 760.00 lb
O.D.: 1.69 in

Database File: (6-18-2015) pge test iw well 1.db
Dataset Pathname: merge7
Presentation Format: temp7
Dataset Creation: Thu Jun 18 15:03:33 2015
Charted by: Depth in Feet scaled 1:600

74 TEMP 2 (degF) 144
-0.3 0.3 0 GR 200
-3.5 DTMP 2 (degF) 3.5

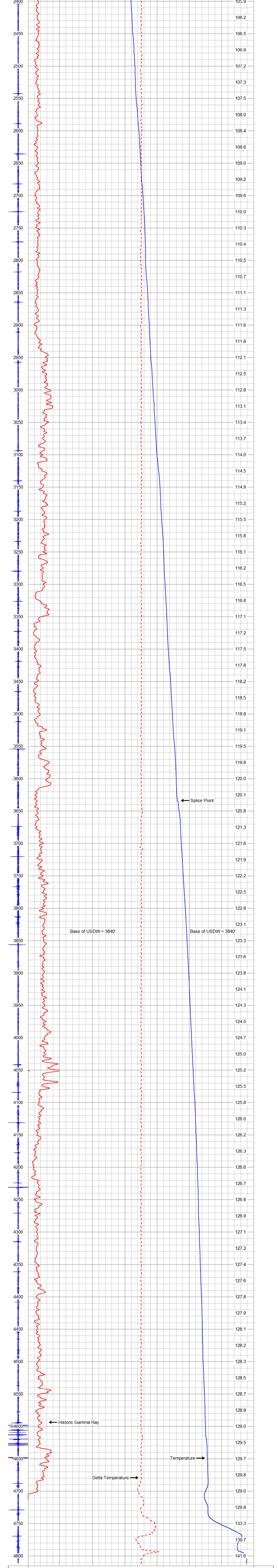
Splice Point
Splice Point
Temperature
Delta Temperature

A graph showing a red wavy line on a grid background. The y-axis has labels at 350, 400, and 450. The x-axis has labels at 82.7, 83.2, 83.5, 83.8, and 84.2. A vertical blue line is at approximately x=350, and a vertical red dashed line is at approximately x=430.

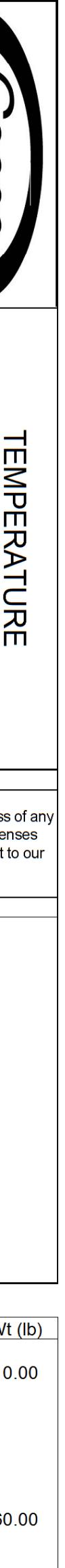
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Y
Z

A graph plotted on a grid background. A vertical blue line is positioned on the far left. To its right, there are several vertical red dashed lines. The horizontal axis features numerical labels at 85.2, 85.4, 85.6, 86.1, 86.5, and 86.9, with the values increasing from left to right.

A grid diagram showing a path from (0,0) to (10,0). The path consists of 10 horizontal segments and 9 vertical segments, all colored red. The path starts at the origin (0,0) and ends at the point (10,0).

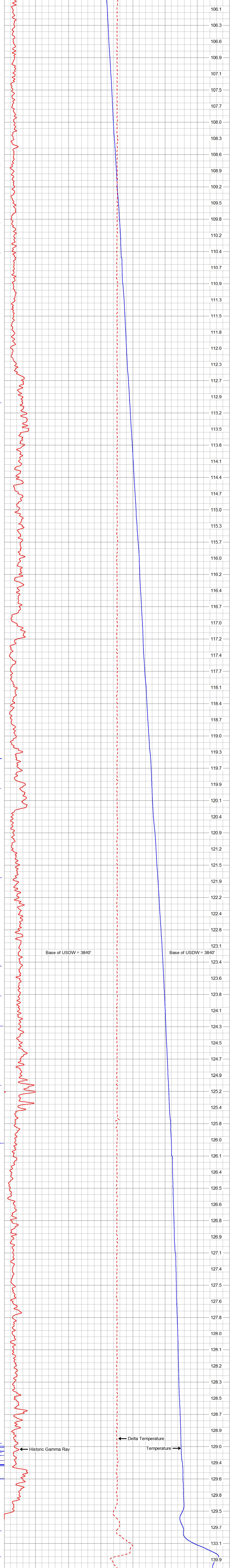
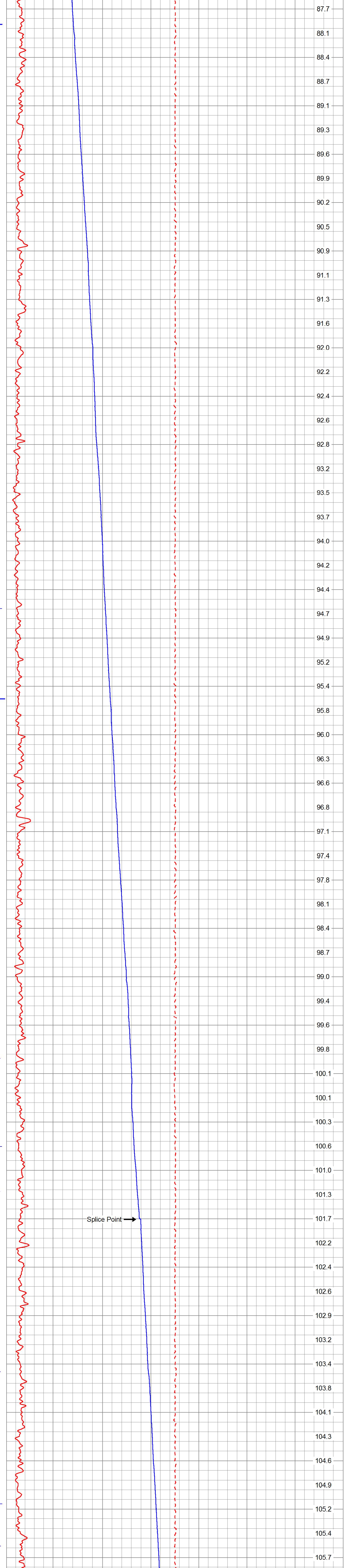


ENCLOSURE 2
Temperature Log Run 2



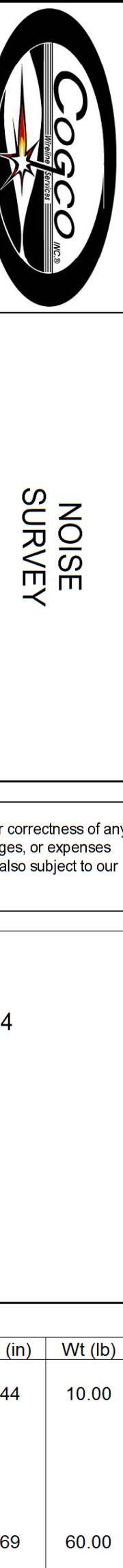
TEMPERATURE SURVEY RUN TWO

Company PG&E		PG&E TEST INJECTION/WITHDRAWAL WELL 1	
Well KING ISLAND GAS	Field KING ISLAND GAS	County SAN JOAQUIN	State CALIFORNIA
Location: NAD27: X:173,388.044 Y:573,467.530 LONG:-121,422.1654		AP #: 04-077-20719	Other Services NOSE SURVEY
SEC 27	TWP 3N	RGE 5E	Elevation -3' 8"
Permanent Datum KB 8.3'	Log Measured From K 8.12'		Elevation 0.0' -3' 8"
<< Fold Here >>			
All interpretations are opinions based on inferences from electrical or other measurements and we cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions set out in our current Price Schedule.			
Comments			
Historic Gamma Ray Log Taken From Halliburton CBL/NCL that was ran 24 Oct. 2014 EPA representative approved horizontal scale for temperature logs; 74 - 144 degrees F. full scale for absolute temperature and 1 degree per inch for delta temperature.			
WELL SHUT IN FROM JUNE 4, 2015			



ENCLOSURE 3
Temperature Log Runs 1 and 2

ENCLOSURE 4
Noise Log



Company	PG&E			
Well	PG&E TEST INJECTION/WITHDRAWAL WELL 1			
Field	KING ISLAND GAS			
County	SAN JOAQUIN			
State	CALIFORNIA			
Location:	NAD27: X:1734880.641 Y:577346.753 NAD83: LAT:38.081988814 LONG:-121.422161054 SEC 27 TWP 3N RGE 5E			
API #:	04-077-20739			
Other Services	NOISE SURVEY			
Permanent Datum	K.B.			
Log Measured From	G.L.			
Drilling Measured From	K.B.			
Date	6-18-2015			
Run Number	TWO			
Depth Driller	4813'			
Bottom Logged Interval	4813'			
Top Log Interval	SURFACE			
Open Hole Size	N/A			
Type Fluid	N/A			
Density Viscosity	N/A			
Max Recorded Temp.	141.8 DEG. F.			
Estimated Cement Top	N/A			
Time Well Ready	8:30AM/3:00PM			
Time logger on Bottom	11:AM/6:21PM			
Equipment Number	740MAST			
Location	WOODLAND			
Recorded By	JAMES LEMM			
Witnessed By	MR. HAMID RANI			
Borehole Record	EPA			
Run Number	Bit			
From	To			
Size	Size			
Wgt/lft	Top			
Bottom	630'			
Liner	5 1/2"			
Production String	9 5/8"			
Prot. String	40# J-55&N-80			
Surface String	WIRE WRAP			
Casing Record	13 5/8"			
STNDRD	Standard Cable Head			
169_5	1 11/16" Tungsten Bar			
169_5	1 11/16" Tungsten Bar			
169_5	1 11/16" Tungsten Bar			
169_5	1 11/16" Tungsten Bar			
CCL-AES (AES_12-44)				
NOISE-NOISE (SDSDEMO)	Noise Tool			
Dataset:	(6-18-2015) pge test iw well 1.db: field/well/run1/merge15			
Total Length:	26.15 ft			
Total Weight:	800.00 lb			
O.D.	1.69 in			
Database File:	(6-18-2015) pge test iw well 1.db			
Dataset Pathname:	merge1			
Presentation Format:	noise			
Dataset Creation:	Thu Jun 18 14:02:44 2015			
Charted by:	Depth in Feet scaled 1:600			
0	GR	250	2	2000HZ (mV)
			2	1000HZ (mV)
			2	600HZ (mV)
			2	200HZ (mV)
Historic Gamma Ray	Taken From Halliburton	CBL/NCL Ran 10/24/2014	50	
			100	
			150	
			200	
			250	
			300	
			350	
			400	
			450	
			500	
			550	
			600	
			650	

The figure consists of two parts. On the left, there is a red waveform plotted against a background of light gray horizontal grid lines. On the right, there is a larger area with a light gray grid. A vertical black line is drawn at the value 700 on the x-axis. A vertical green line is drawn at the value 750. A vertical blue line is drawn at the value 775. The y-axis on the right has major tick marks at 700, 750, and 800.

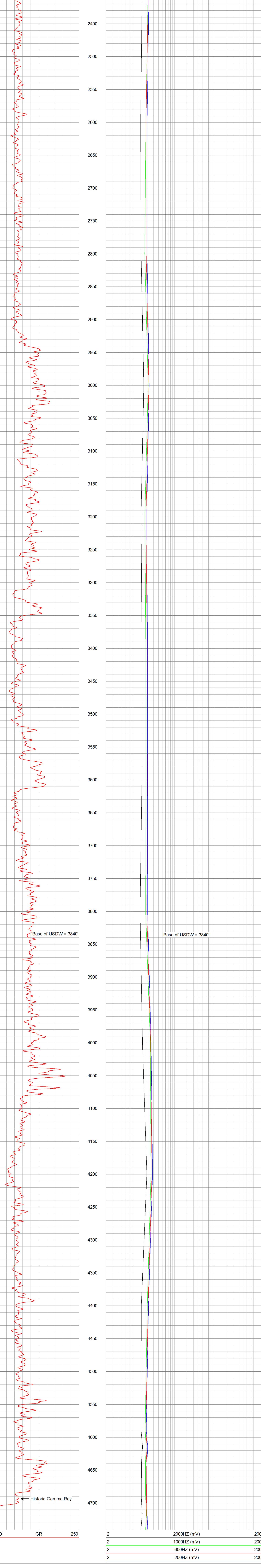
1

A graph with a grid background. The y-axis on the left has labels at 1000, 1050, and 1100. Three vertical lines are plotted: a green line at approximately x=500, a red line at approximately x=510, and a blue line at approximately x=515. All three lines show a sharp peak near the top of the grid.

A plot showing three vertical lines (black, green, red) on a grid background. The y-axis has a label '1100' at the top.

1150

This figure consists of two main parts. The left side features a vertical red line with a high-frequency, low-amplitude oscillation pattern. The right side shows a vertical strip with a grid background. Within this strip, there are three distinct vertical lines: a black line, a green line, and a blue line. All three lines exhibit a similar high-frequency oscillation pattern, mirroring the red line on the left. The vertical axis on the right side has numerical labels starting from 1250 at the top and increasing by 50 units down to 2400 at the bottom.



ENCLOSURE 5
External MIT Field Report

PG&E
External MIT Report

DATE June 18, 2015
LEASE # _____

DWC _____
TWC _____

REPORT # 1
ACT.DAYS 1
PR. DEPTH 4813'

OBJECTIVE FORMATION Mokelumne

WELL TYPE CAES

LOCATION: King Island

WELL NAME PG&E Test I-W Well No. 1
RIG _____
LAST BOP TEST _____

CNTY/STATE San Joaquin, CA
LAST CSG. 9-5/8", 40.0#, J-55/N-80

API # 077-20739
SET @ 4716
CO. MAN: Hamid Irani (916 716-3422)

Time	HRS.	OPERATIONS SUMMARY
07:00		Moved in Cogco Wireline. Attended safety meeting with Cogco. Rigged up mast. Found the well shut-in (since 06/04/15) with 1810/136 psia. Removed Well cap. Installed 3-1/2"-EUE X 5-1/2" LTC cross-over on PG&E Test I-W well No.1. Nippled up Cogco lubricator. Opened the well (08:30) and RIH with Temperature/CCL Tools. Wireline stopped at 70'. Pulled out wireline and added another sinker bar and started running in hole with Temperature/CCL tools (09:00). <u>Ran Temperature Logs from Surface to 4813'</u> . Cogco ran temperature/CCL tools from surface to 4813' (tagged) at a speed of 36'~47' per minute and recorded temperature data, witnessed and approved by EPA representative. POOH (11:00). Laid down temperature tool. Picked up noise tool. <u>Ran Noise Logs</u> . Cogco ran Noise/CCL tools to 4741' and recorded noise data at 4741', 4716', 4691', 4639', 4614', 4589', 4400' and then every 200' to 200' from surface. EPA representative witnessed and approved noise logging. No leaks or suspected leak interval was detected. Pulled out and laid down noise tools. Shut the well in. Picked up temperature tool. Opened well (15:00, 4 hours after the first temperature log). Found the well with 1810/137 psig. RIH with wireline and temperature and CCL tools. <u>Ran Temperature Logs from Surface to 4813'</u> . Cogco ran temperature/CCL tools from surface to 4813' at a speed of 36' per minute and recorded temperature data, witnessed and approved by EPA. Compared the log to the first temperature log and did not notice any anomalies. POOH with logging tools and wireline. Closed well (18:30). Laid down tools. Removed cross-over. Cameron changed cap O-ring and installed cap. Opened master valves and did not notice any leak off the cap. Locked out all of the tree valves. Secured well. Moved Cogo off location.
20:30		
Tot. Hrs.	13.5 hrs.	Daily Water Use: Total Water Use:
REMARKS: _____		
